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(71) Applicants P.A. Management Consultants Limited, (Great Britain), Hyde Park House, 60a Knightsbridge, London.
(72) Inventors John Richard Archer
(74) Agent and/or Address for Service Keith W. Nash and Co., 90-92 Regent St., Cambridge CB2 1DP.

(54) Making cutting tools

(57) Method and apparatus for constructing a press knife blade wherein a slotted strip guide (32) laterally constrains a length of metal strip material which is advanced incrementally through the drive of a linear actuator (62) to a bending tool just in front of the head of the guide, and respective drive means for the feed actuator and the bending tool are controlled so as to produce bends in the strip material according to a predetermined pattern, each of the bends being made up of a plurality of small incremental bends introduced into the strip material by a sequence of steps comprising a linear advance of the strip by a controlled distance and a lateral deflection of the advanced strip by a controlled amount, each incremental bend so produced being formed in the strip material whilst the latter is held stationary in the strip guide between the increments of advance. A preferred bending tool consists of a rotatable platform (38) wherein is eccentrically mounted a retractable pin (40), which latter in its projected position laterally engages the strip material to effect bending thereof when the platform is rotated.

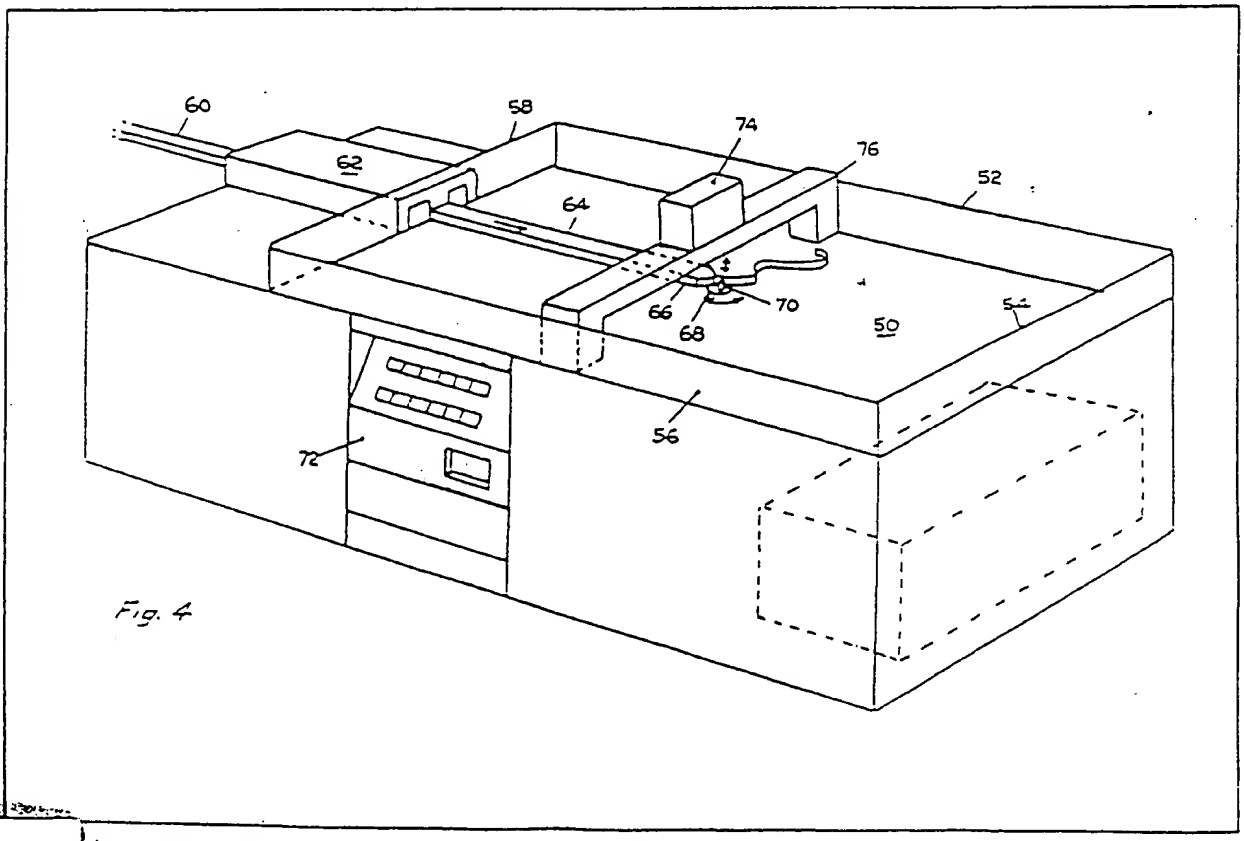

Fig. 4

Drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

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SPECIFICATION

Apparatus for making cutting tool

Field of invention

This invention concerns apparatus for forming blades which can the be used as the cutting blades in cutting tools particularly cutters for cutting out areas of sheet material such as leather as a preliminary stage to a manufacturing process.

The invention is of particular application to the construction of so-called press knives for cutting out leather blanks from which boots and shoes can subsequently be constructed but is not limited to this application.

Background to the invention

Shoe Manufacturers currently manufacture press knives for leather cutting by a manual method using card templates. Variation of style width and size mean that only one knife of each type is usually required and fashion changes demand a regular flow of new profiles.

One present method of manufacturing press knives employs a "V" block into which the blade is bent locally under the action of a foot operated pin or other deflecting device. The operator uses the card template as a visual guide and by creating a number of local bends at discreet points along the blade produces a profile which approximates adequetly to the desired smooth shape of the card blank. Where particularly acute bends are required a combination of heat and broaching together with additional tools enables the operator to produce the substantial deformation without cracking the material.

Due to spring-back of such strip material, the blade has to be bent through a greater angle than is actually required at each bend and hitherto the degree of over bending has been determined by the experience and skill of the operator and by the continuous visual inspection which he provides.

Profile tolerance achievable with this type of method is typically plus or minus 1/64" (plus or minus 0.4 millimetres) and a knife for a piece such as an inquarter will require approximately 60 discreet bends.

It is an object of the present invention to provide apparatus by which the blades for shaped knives can be constructed particularly blades for press knives for cutting out leather.

Summary of the invention

According to the present invention apparatus for constructing a shaped knife blade from a length of metal strip comprises:-

1) a magazine for strip material,

2) means for conveying strip material from the magazine to a working region,

3) a strip exit through which strip passes into the working region,

4) a pair of jaws at the strip exit for gripping the strip and holding the same in a fixed position during a forming operation in the working region

5) a bending tool situated in the working region and spaced from the jaws of the strip exit, the tool being moveable in a controlled manner into lateral engagement with the strip so as to bend the length of the strip which extends between the jaws and the bending tool,

6) first drive means for advancing the strip material through the exit

7) second drive means for moving the bending tool to effect bends in the strips material,

8) control means for controlling the first and second drive means so as to produce bends in the strip material according to a predetermined pattern, each of the bends being made up of a plurality of small incremental bends introduced into the strip material by a sequence of steps comprising a linear advance of the strip by a controlled distance and a lateral deflection of the advanced strip by a controlled amount, each incremental bend so produced being formed in the strip material whilst the latter is held stationary in the jaws between the increments of advance.

According to a preferred feature of the invention

1) an input into which a device containing information relating to the required pattern of bends can be introduced, and

2) means for reading the information from the said device, and

3) means for converting the information so obtained into a sequence of signals for supply to the said control means for controlling the first and second drives.

Where the information relating to the required bending pattern is contained in the form of a shaped blank the input device associated with the control means preferably comprises a slit into which the blank can be pushed and means within the slit for holding the blank and either moving the blank adjacent a follower or moving a follower around the blank or both so as to obtain from movement of the follower relative to a datum position, information relating to the required bends in the strip material.

Such a blank may be in the form of a piece of card or plastics material or wood or metal.

According to a particularly preferred feature of the invention, the blank may comprise a metal plate which is to form part of the final knife assembly and is formed by an accurate cutting procedure such as a laser cutter or the like.

In another arrangement the shape information for the bending may be contained on punched tape, a magnetic disc, a magnetic tape, or in a semi-conductor memory chip or the like and the input to the control means includes means for receiving the tape or disc or chip and means for reading same and converting the information derived therefrom into electrical signals and means is provided for supplying the electrical signals as appropriate input signals to the control means for controlling the first and second drives.

It will be appreciated that the first and second drives need not necessarily be electrically powered and the control system, therefore, need not necessarily be responsible to electrical signals. Accordingly where the information required to bend the strip to a particular pattern is in a form which will normally be read out and converted into electrical

signals, suitable transducer means is provided to convert the electrical signals into mechanical movement or hydraulic or pneumatic signals depending on the nature of the control system and drives.

In a preferred arrangement, the drives are either electric drives or respond to electrical signals and the control means for the first and second drives is an electrical control system and information relating to the pattern of the bends is such as to be capable of being converted into or is stored as electrical signals of a type to which the control means will readily respond.

The apparatus according to the invention may conveniently include a severing device for severing a length of formed strip from the remainder of the strip held by the exit jaws. Severence is conveniently effected immediately adjacent the exit jaws.

In general the cutting tools which the knife blades are intended for require a continuous knife edge to be presented to the sheet material which is to be cut so as to allow a complete area of the sheet material to be cut out and removed from the remainder of the sheet. Clearly to form such a knife blade by a series of bends in a long length of strip material may cause the already formed and bent sections of the strip material which has already advanced through the exit jaws to begin to interfere either with the bending tool or with the exit or both. Where this is likely to occur, the blade is conveniently formed in more than one section and the sections are then brazed or welded or otherwise bonded together or simply fitted around a central shaped plate and bonded to the plate so as to form the continuous knife edge.

According to a further feature of the invention, the bending tool comprises a rotatable platform and a pin which can be raised and lowered relative to the platform so that the pin can either protrude above the platform or can wholly be contained within the platform and the platform is mounted flush with a flat working surface in the working region of the apparatus according to the invention just beyond the exit jaws and drive means is provided for rotating the platform and for raising and lowering the pin.

Bends can be introduced into strip material protruding beyond the exit jaws by rotating the platform so as to bring the pin into contact with one side or the other side of the protruding strip and causing a deflection of the strip protruding from the jaws.

According to a preferred feature of the invention the bending action is effected by a series of incremental advances of the strip material through the exit slit containing the jaws and angular movement of the platform containing the pin after each incremental advance of the strip material so that a series of small bends are introduced into the material and the radius of the bend will be dictated by the freqency of the bends and the angular bending of the incremental bend. Both of these variables can be controlled by adjusting the step size of the incremental advance and the angular movement of the plateform and pin so that from this it can be seen that almost any desired bend can be introduced into a strip within the constraints imposed by the yield strength of the strip material.

Where bending in one direction is to be followed by bending in another direction, the pin is retracted into the plateform after the required number of incremental bends have been formed in the one direction, the plateform is rotated to place the pin on the opposite side of the strip and the pin is advanced once again and the bending process repeated this time the pin impinging against the face of the strip from the opposite side so as to introduce opposite sense curvature into the strip material.

According to another aspect of the invention a method of forming a knife blade comprises the steps of:-

1) advancing strip material through an exit slit in a series of incremental steps,

2) clamping the strip material firmly between each said incremental advance to prevent any longitudinal movement of the strip material between said incremental advances thereof,

3) deflecting the protruding strip material between each said incremental advance thereof either from one side or the other, through a controlled angle,

4) means for controlling the strip advance drive and the deflection of the strip in response to information relating to the desired bends to be introduced into the strip material and,

5) means for severing a length of bent strip material from the remainder of the strip held in the exit, the severed length constituting some or all of a cutter blade.

A press cutter can be constructed in accordance with the invention by forming one or more blade sections in accordance with the aforementioned method, and securing as by welding or brazing or otherwise bonding at least one metal strut internally of the shaped blade or blade sections and securing either thereby or by additional welding or brazing or bonding any free ends of the blade or blade sections so as to form a continuous cutting edge.

According to a particularly preferred feature of the invention, a ridged plate member is fitted within the shaped blade or the blade sections are fitted around the said shaped rigid plate and bonded thereto as by welding or brazing or the like.

Conveniently the plate is formed by an accurate cutting process using shape and dimension information from which the bending information for controlling the bending of the strip is also derived.

Alternatively the bending information for bending the strip may be derived from the shape of the cut-out plate which is therefore formed first.

According to a still further feature of the invention the shaped plate may itself by apertured and conveniently includes one or more large apertures to allow material trapped within the continuous blade (when in use) to be pushed out of the cutter and smaller apertures into which pins or so-called prickers can be fitted and secured as by bonding and the like so as to provide for the marking or perforating of the sheet material which is to be cut out by the cutter.

The solid rigid plate will normally be formed from metal but it is to be understood that wood or plastics material or any laminate or combination of such materials may be used for the plate.

The apparatus of the invention conveniently furth-

er comprises at least one pair of rollers for feeding the strip material through the exit slit, the rotation of the rollers being servo controlled. Such an arrangement is relatively compact but assumes that no slippage or creep can occur between the strip and the roller surfaces. Any such slippage or creep would cause the profile accuracy to be lost.

Alternatively the drive means for the strip material comprises a linear actuator again under positional servo control such an arrangement conveniently comprises a clamp on a feeding head and a second clamp adjacent to a bending head in which the feed head clamp remains actuated during feeding whilst the bending head clamp releases during feeding. Conveniently the feed clamp releases at the end of the actuator stroke and the actuator can then return to its start position and reclamp. In such an arrangement a long strip length can be progressively fed through using a relatively short actuator stroke. Such an arrangement is a preferred method of feeding the strip material.

Conveniently the strip material is threaded through slotted guides to eliminate buckling.

In one embodiment of the invention, the strip exit is located above a horizontal table onto which the strip material is fed.

Conveniently servo hydraulic actuators are used for de-reeling the strip material from which the cutting blade is to be formed.

Typically the drives for advancing the strip material longitudinally comprises linear actuators such as hydraulic actuators and typically have a 500 millimetre stroke.

Conveniently the drive for angularly displacing the plateform containing the bending pin comprises a semi-rotary vane type actuator. Such actuators can provide up to 280° of rotation i.e. plus or minus 140° from dead centre and this is adequate for all but the most acute bends.

Preferably positional transducers are provided associated with both the feed and bend actuating mechanisms to feed back information to the control means.

The positional transducers may be either digital (for example optical) or analogue (i.e. potentiometric or inductive) devices. Conveniently all such sensitive and readily damaged components are mounted beneath the horizontal table onto which the strip is fed.

According to a further preferred feature of the invention, where broaching is required to prevent cracking of the strip material during bending, a broaching head may be incorporated in the feed line upstream from the bending head.

Where the apparatus includes a severing device, the latter conveniently comprises a high speed edge cutter for parting the finished knife blade from the strip material remaining in the exit.

Conveniently the edge cutter descends from above the bending head.

The apparatus may further comprise means for conveying the completed knife blade or knife blade section or sections to an exit chute or collection point on the said horizontal table.

The apparatus according to the invention may further comprise means for marking each blade or blade section after it has been formed before or after severence from the remainder of the strip material. The marking conveniently allows the blade component to be identified, the support plate for the blade to be identified and the assembled knife to be identified.

According to a further aspect of the invention, means is provided for indenting the cutting edge of the knife blade or blade section. In general the indentation of the knife blade must be controlled by a human operator who will need to determine the most convenient portion of the knife blade edge in which the indentations are inserted so as to avoid physically marking the material which is subsequently to be cut out at a position which is viable on the assembled product. The edge identations serve to identify the material which has been cut out by a knife incorporating the blade or blade sections so as to allow the cut out pieces of material to be readily identified by subsequent operators or machines in the manufacturing process for which the cut out blanks of sheet material are required.

The invention also lies in a cutter blade or section or cutter blade when constructed in accordance with the method of the invention.

The invention also lies in a knife cutter asembled from a cutter blade or blade sections when formed by the method and apparatus of the invention.

The invention will now be described by way of example with reference to the accompanying drawings in which:-

Figure 1 is a data flow part of the system for forming a knife in accordance with edge profile Information

Figure 2 is a plan view from above of a bending station of apparatus in accordance with the invention,

Figure 3 is a partial cross-section through the bending head shown in Figure 2, and

Figure 4 is a diagrammatic representation of a complete knife blade forming machine incorporating incremental bending of strip material in accordance with the invention, and

Figures 5, 6 7, and *8* show the various stages in the manufacture of a press knife using blade sections formed by the method and apparatus of the invention.

Detailed description of drawings

In Figure 1, the data flow path of a system incorporating the invention is shown as comprising extraction of data from a computer system at 10 and the analysis and interpretation of the data at 12 to provide three channels of information.

The main channel includes a stage 14 for converting the analysed data to machine increment instructions.

Thereafter these instructions are supplied at 16 to the control of a bending machine with or without broaching.

Where automated inspection of the bending process is provided for, this will occur at 18 and after all of the bends have been formed, completed or partially completed knife blade is cut off at 20 and

transferred to an assembly station at 22 where parts of the knife blade are welded together. Thereafter the blade is marked at 24.

Information from the analysis and interpretation stage 12 is also passed by the left-hand channel through a data translation stage 26 to provide information for assembling the parts which go to make up the completed knife blade and this information is supplied as a further input to the assembly stage 22.

Lastly the data from the stage 12 is provided via a data translation stage 28 to provide information from which the support plate can be manufactured. This information is supplied to a support plate manufacturing stage which involves a cutter or like device for removing material from plate in a correct shape and to a correct size as a 30 and holes are formed in the support plate to receive the so-called prickers. The support plates from the manufacturing stage 30 are then supplied as a further input to the assembly stage 22.

Figure 2 shows somewhat diagrammatically how the strip material can be bent to form the different curves and bends of the knife blade profile. To this end a strip guide 32 serves to constrain a length of strip metal material 34 to move along a generally straight path and through the outlet of a snout generally designated 36.

In the line of the outlet of the snout, is located a spindle 38 which is rotatable or angularly deflectable from a mean position so that an upstanding pin 40 can exert lateral force on the strip material protruding through the snout as at 42 so as to form a bend.

The bending pin 40 is conveniently retractable fully into the rotatable spindle 38 so that the latter can be rotated so as to position the bending pin 40 on the opposite side of the protruding blade 42.

Figure 3 shows in cross-section how a bending pin or head 40 can protrude from a spindle 38. The spindle is a cylindrical member having an enlarged radial flange 44 at one end and an aperture through which the pin 40 can protrude.

A hydraulic semi-rotary actuator 46 rotates the spindle 38 to the desired angular position and means (not shown) is provided for moving the pin 40 in an outward direction relative to the spindle 38 for engagement with one side or the other of the protruding strip material.

Figure 4 shows a typical layout for an incremental bending machine to produce complex knife blades. The bending station comprises a flat table 50 having a guard on four sides at 52, 54, 56 and 58. The table provides a support for a metal strip part of which can be seen after it has been bent at 58. Before being bent the strip material is relatively straight as at 60. After the blade material has passed through an actuator 62 for incrementally advancing the material. The latter is then supplied via a guide 64 to an outlet snout 66 through which the material protrudes as it is incrementally advanced.

A spindle 68 supports a bending pin 70 which can protrude above the level of the spindle as shown or be retracted into the spindle so as to lie flush with the surface of the spindle.

The incremental feed actuator 62, and the spindle actuator require control signals which are derived from a computer, the control panel for which is denoted by reference numeral 72.

The completed blades are severed from the stock strip material by means of a cutting tool (not shown) mounted together with a cutter tool actuator 74 on a bridge 76 which extends across the width of the platform or table 50.

Conveniently the bridge is movable so as to allow for a selection of the position at which the cutting tool will operate.

In Figure 5 there is shown a profiled and accurately cut out or stamped plate generally designated 110 which constitutes the central rigid web of a knife for removing areas of sheet materials such as leather or fabric material for the purpose of forming blanks from which shoes, boots or clothes can be formed.

The blank is formed by an accurate cutting process such as laser cutting or NC nibbling or the like and includes one or more central apertures (two being shown in Figure 1 at 112 and 114) and a plurality of small holes such as 116.

The apertures such as 112 and 114 allow sheet material adhering to a blade and located within the blade profile to be pushed out when the knife is in use.

The smaller holes such as 116 are adapted to receive prickers or pins (to be described) which can be secured therein so as to protrude on at least one side if not both sides of the plate.

Figure 6 shows two segments 118 and 120 of a blade formed from strip material which is bent so as to conform to the outside shape and configuation of the support plate 110. The segments 118 and 120 are adapted to be welded or otherwise secured such as by brazing to the outside periphery of the plate 110 and the latter is used to constrain the blade segments 118 and 120 so as to form precisely the correct outline of blade. The abutting ends of the two blade segments may themselves be welded or otherwise joined so as to form a continuous knife edge after the blade segments are fitted around and secured to the plate 110.

In Figure 7 there is shown to an enlarged scale a pricker. This comprises an upper pointed end 122 and a complementary lower pointed end 124 which are integral with a central generally cylindrical section 126 which may be grooved so as to form a good key with the material from which the plate 110 is formed when the cylindrical section 126 registers with the thickness of the plate 110.

The pricker is effectively a double-ended pin and the central generally cylindrical section 126 is dimensioned so as to correspond to the thickness of the plate 110 so that the sharpened pointed ends of the pin or pricker as it is called just protrude by the required amount from the opposite faces of the plate 110. The prickers may be secured in position as by an adhesive or bonding agent or may be simply push-fitted into position or may be welded or otherwise secured to the material from which the plate is constructed.

Figure 8 shows a completely assembled knife with prickers designated 128 fitted into the smaller holes 116 in the plate 110 and with the two blade segments

120 and 118 fitted around and secured as by welding to the external edge of the plate 110.

The plate 110 may be formed from metal or plastics material or wood or any suitable combination thereof.

CLAIMS

1. Apparatus for constructing a shaped press knife blade from a length of metal strip material, comprising:

a slotted head for laterally gripping strip material advanced intermittently therethrough, in the lengthwise direction,

a bending tool adjacent the head at the exit end thereof, the tool being movable in a controlled manner into lateral engagement with the strip so as to bend the length of strip between said head and said tool,

first drive means for advancing the strip material intermittently through the head,

second drive means for moving the bending tool to effect the bends in the strip material, and

control means for controlling the first and second drive means so as to produce bends in the strip material according to a predetermined pattern, each of the bends being made up of a plurality of small incremental bends introduced into the strip material by a sequence of steps comprising a linear advance of the strip by a controlled distance and a lateral deflection of the advanced strip by a controlled amount, each incremental bend so produced being formed in the strip material whilst the latter is held stationary in the head between the increments of advance.

2. Apparatus according to claim 1, wherein the control means includes:

1) an input into which a device containing information relating to the required pattern of bends can be introduced, and

2) means for reading the information from the said device, and

3) means for converting the information so obtained into a sequence of signals for supply to the said control means for controlling the first and second drives.

3. Apparatus according to claim 2, including a shaped blank defining information relating to the required bending pattern.

4. Apparatus according to claim 3, wherein the input for the control means comprises a slit into which the blank can be pushed and means within the slit for holding the blank and either moving the blank adjacent a follower or moving a follower around the blank or both so as to obtain from movement of the follower relative to a datum position information relating to the required bends in the strip material.

5. Apparatus according to claim 3 or claim 4, wherein the shaped blank is constituted by a support plate which is to form part of a final knife assembly, said support plate being accurately preformed with a shape corresponding to a desired knife configuration.

6. Apparatus according to claim 2, wherein the information relating to the required bending pattern is contained on punched tape, a magnetic disc, a magnetic tape, or in a semi-conductor memory chip or the like and the input to the control means includes means for receiving the tape or disc or chip and means for reading same and converting the information derived therefrom into electrical signals and means is provided for supplying the electrical signals as appropriate input signals to the control means for controlling the first and second drives.

7. Apparatus according to any of claims 1 to 6, wherein the control means is an electrical control system, and transducer means is provided to enable such system to control first and/or second drive means which are non-electrical.

8. Apparatus according to any of claims 1 to 6, wherein the first and second drive means are either electric drives or respond to electrical signals and the control means for the first and second drives is an electrical control system and information relating to the pattern of the bends is such as to be capable of being converted into or is stored as electrical signals of a type to which the control means will readily respond.

9. Apparatus according to any of claims 1 to 8, including cutting means for severing a length of formed strip from the remainder of the strip retained by the slotted head.

10. Apparatus according to claim 9, wherein the cutting means is disposed immediately adjacent the head.

11. Apparatus according to claim 9 or claim 10, wherein the severing means is operable to cut two or more pieces of formed strip material for the formation of a given knife blade, the apparatus including an assembly means at which the two or more pieces are fixed together into a desired knife blade configuration.

12. Apparatus according to any of claims 1 to 11, wherein the bending tool comprises a rotatable platform and a pin which can be raised and lowered relative to the platform so that the pin can either protrude above the platform or can wholly be contained within the platform.

13. Apparatus according to claim 12, wherein the platform is mounted flush with a flat working surface just beyond the head and drive means is operable for rotating the platform and for raising and lowering the pin.

14. Apparatus according to claim 13, wherein the bending action is effected by a series of incremental advances of the strip material through the exit slit containing the head and angular movement of the platform containing the pin after each incremental advance of the strip material so that a series of small bends are introduced into the material and the radius of the bend will be dictated by the frequency of the bends and the angular bending of the incremental bend.

15. Apparatus for constructing a shaped knife blade from a length of metal strip comprising:-

1) a magazine for strip material,

2) means for conveying strip material from the magazine to a working region,

3) a strip exit through which strip passes into the working region,

4) a pair of jaws at the strip exit forming a snout for gripping the strip and holding the same in a fixed position during a forming operation in the working region,

5) a bending tool situated in the working region and spaced from the jaws of the strip exit, the tool being movable in a controlled manner into lateral engagement with the strip so as to bend the length of the strip which extends between the jaws and the bending tool,

6) first drive means for advancing the strip material through the exit,

7) second drive means for moving the bending tool to effect bends in the strip material,

8) control means for controlling the first and second drive means so as to produce bends in the strip material according to a predetermined pattern, each of the bends being made up of a plurality of small incremental bends introduced into the strip material by a sequence of steps comprising a linear advance of the strip by a controlled distance and a lateral deflection of the advanced strip by a controlled amount, each incremental bend so produced being formed in the strip material whilst the latter is held stationary in the jaws between the increments of advance.

16. Apparatus according to claim 15, wherein the strip drive means includes at least one pair of rollers for feeding the strip material through the exit slit, the rotation of the rollers being servo controlled.

17. Apparatus according to claim 15, wherein the first drive means for the strip material comprises a linear actuator under servo control.

18. Apparatus according to claim 17, wherein said actuator comprises a clamp on a feeding head and a second clamp adjacent to a bending head in which the feed head clamp remains actuated during feeding whilst the bending head clamp releases during feeding, the feed clamp releasing at the end of the actuator stroke to enable the feeding head to return to its start position and reclamp.

19. Apparatus according to any of claims 15 to 18 wherein the second drive means comprises a semi-rotary vane actuator.

20. Apparatus according to any of claims 15 to 19, including positional transducers associated with the first and second drive means for feeding back information to the control means.

21. Apparatus according to any of claims 15 to 20 including a broaching means upstream of the bending tool.

22. Apparatus according to any of claims 15 to 21, including cutting means adjacent the bending tool for severing the formed strip material from the stock thereof and means for moving the severed strip material out of the region of the bending tool.

23. Apparatus according to any of claims 15 to 22, including means for indenting the cutting edge of the knife blade.

24. A method of constructing a shaped press knife blade which comprises the steps of:-

1) advancing strip material through an exit slit in a series of incremental steps,

2) clamping the strip material firmly between each said incremental advance to prevent any longitudinal movement of the strip material between said incremental advances thereof,

3) deflecting the protruding strip material between each said incremental advance thereof either from one side or the other, through a controlled angle,

4) means for controlling the strip advance drive and the deflection of the strip in response to information relating to the desired bends to be introduced into the strip material, and

5) means for severing a length of bent strip material from the remainder of the strip held in the exit, the severed length constituting some or all of a cutter blade.

25. A method according to claim 24, including the step of fixing a strengthening member within the formed strip material in order to complete the knife blade.

26. A method according to claim 25, wherein the strengthening member is a ridged plate member conforming to a desired knife blade configuration.

27. A method according to claim 26, including the step of forming the plate member using shape and dimension information derived from data from which the bending information is also derived.

28. A method according to claim 26, wherein the information for bending the strip material is derived from the shape of the plate member.

29. A method according to any of claims 23 to 28, wherein the shaped plate is apertured and includes one or more large apertures to allow material trapped within the continuous blade (when in use) to be pushed out of the cutter and smaller apertures into which pins or so-called prickers can be fitted and secured as by bonding and the like so as to provide for the marking or perforating of the sheet material which is to be cut out by the cutter.

30. A method according to any of claims 23 to 28, wherein the strengthening member is formed of metal and the formed strip is welded or brazed thereto.

31. Apparatus for constructing a press knife blade substantially as hereinbefore described with reference to the accompanying drawings.

32. A method of constructing a press knife blade substantially as hereinbefore described with reference to the accompanying drawings.

33. A press knife blade constructed by the apparatus of any of claims 1 to 23 or claim 31.

34. A press knife blade constructed by the method of any of claims 24 to 30 or claim 32.

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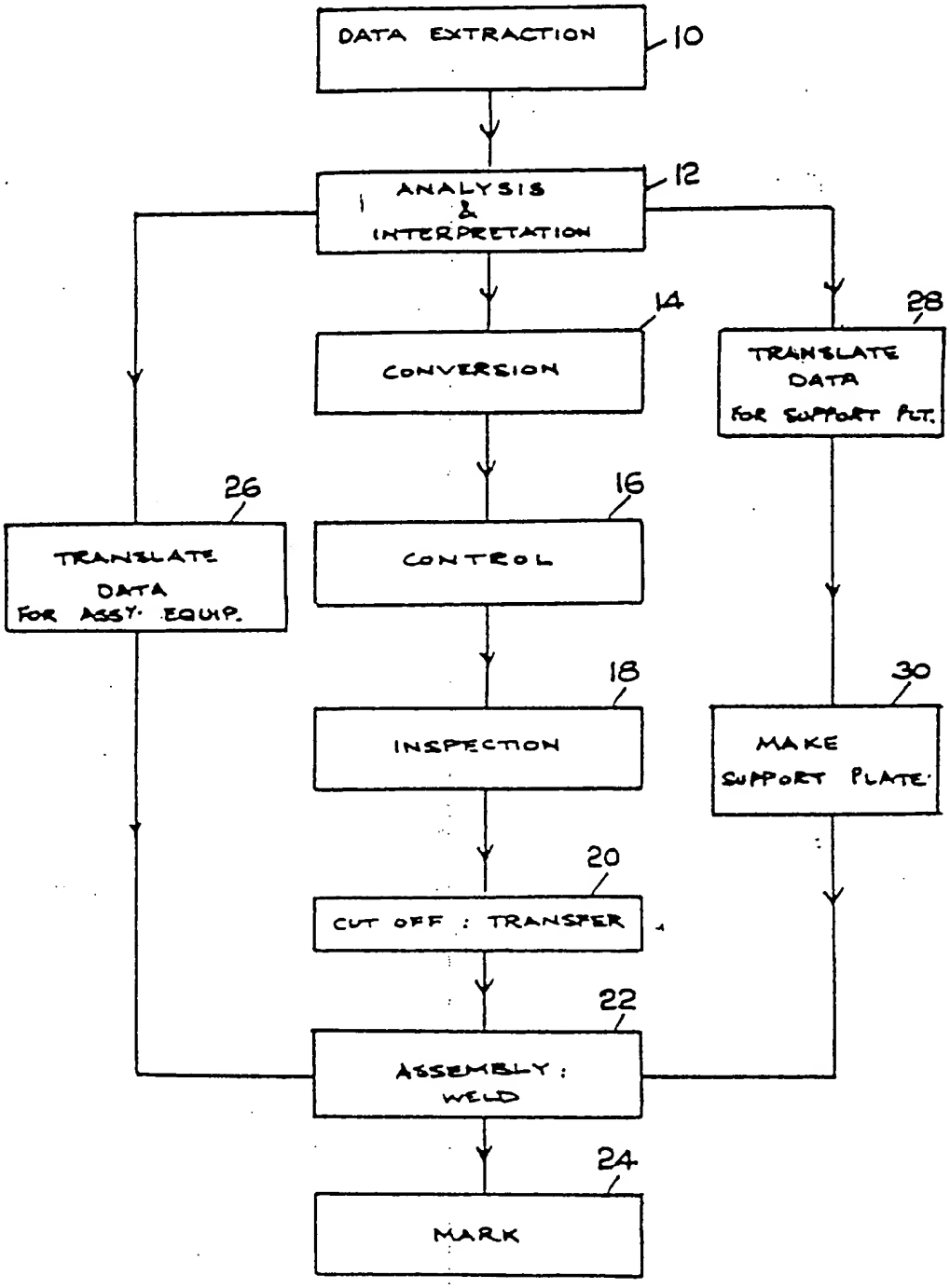
DATA EXTRACTION
10
ANALYSIS & INTERPRETATION
12
CONVERSION
14
TRANSLATE DATA FOR SUPPORT PLT.
28
TRANSLATE DATA FOR ASSY. EQUIP.
26
CONTROL
16
INSPECTION
18
MAKE SUPPORT PLATE
30
CUT OFF : TRANSFER
20
ASSEMBLY : WELD
22
MARK
24

Fig. 1

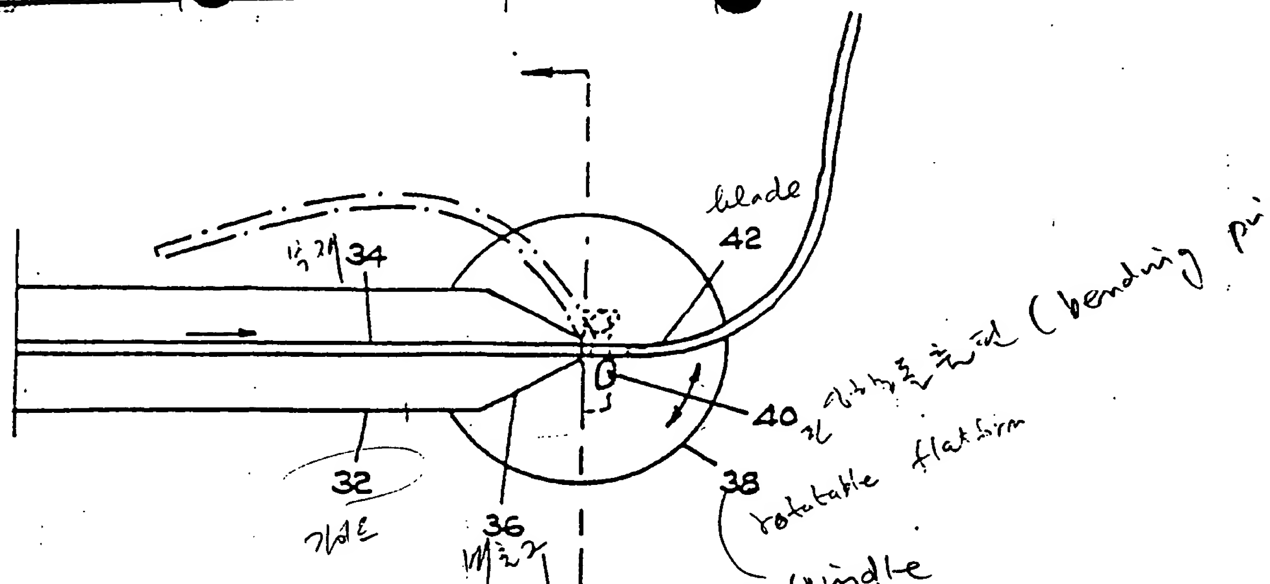
blade
42
34
40
32
36
38
spindle

Fig. 2

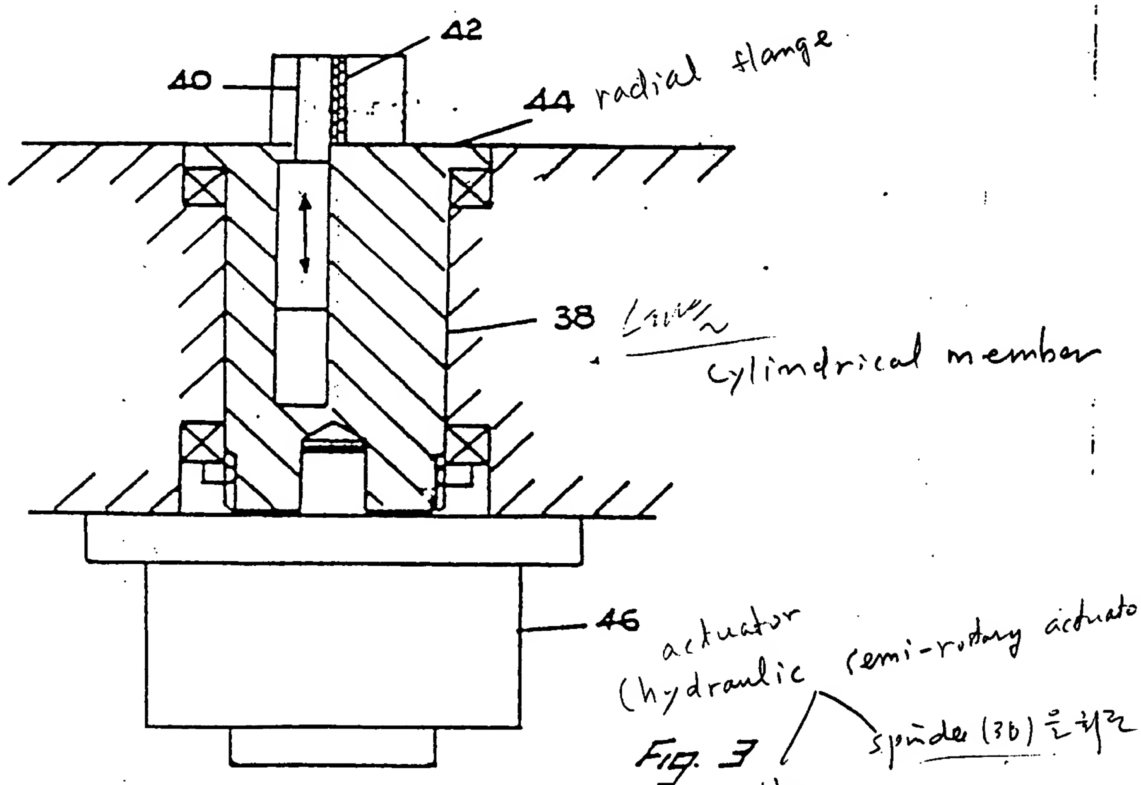
42
40
44 radial flange
38
cylindrical member
46
actuator
(hydraulic semi-rotary actuato

Fig. 3

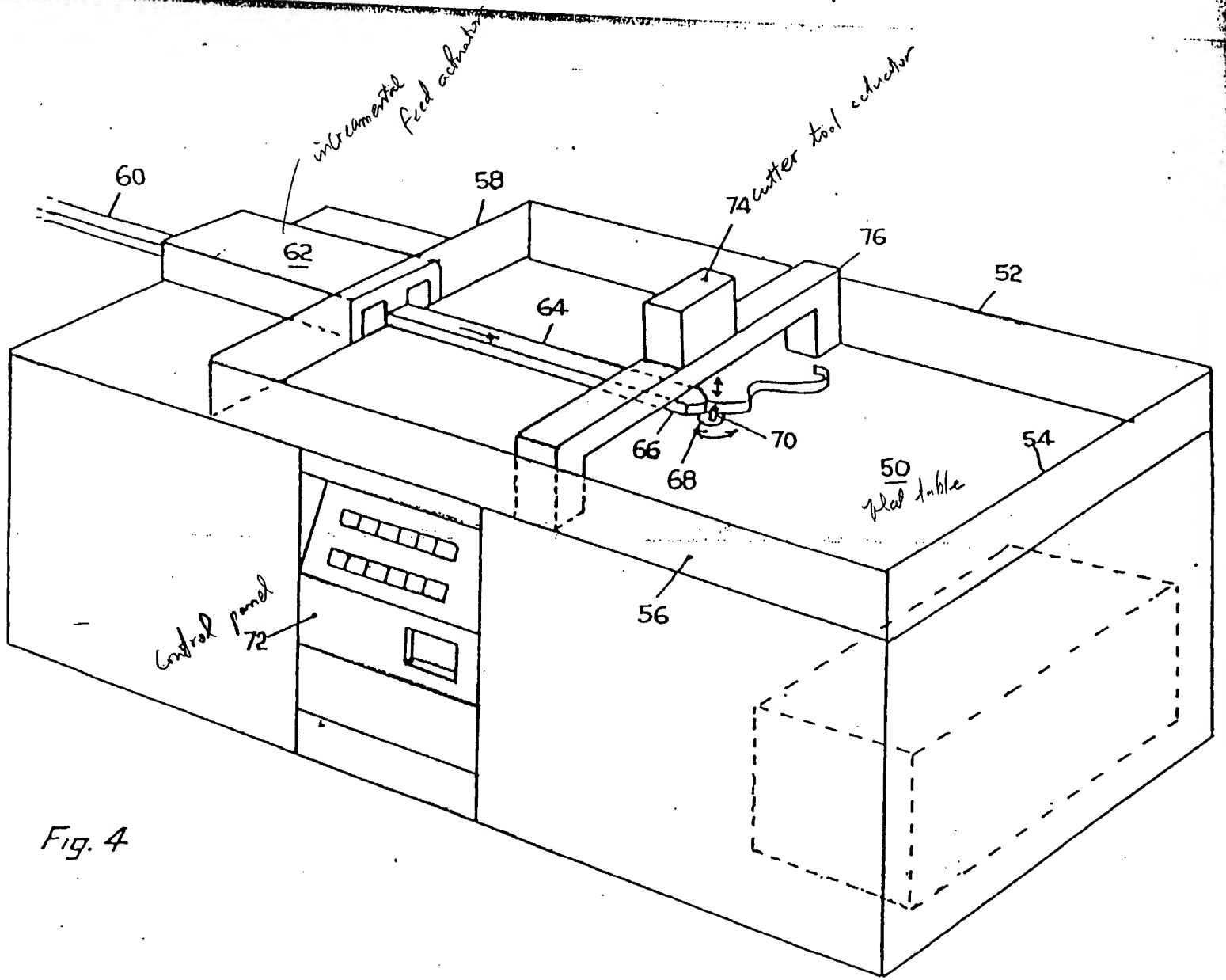
incremental feed actuator
cutter tool actuator
60
58
74
76
52
62
64
66
68
70
54
50
flat table
56
control panel
72

Fig. 4

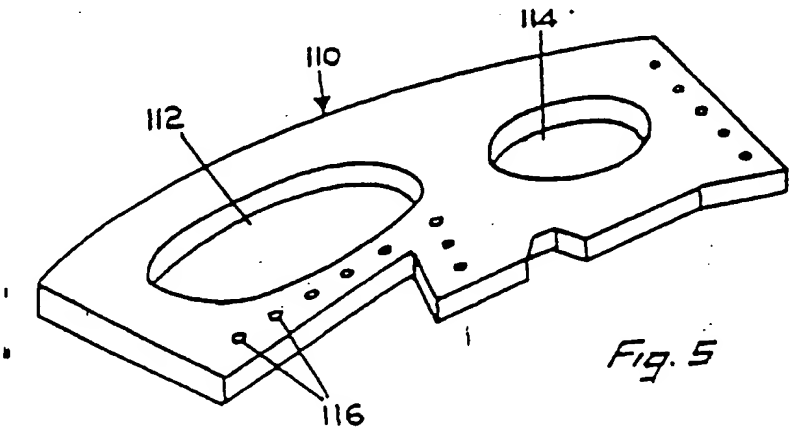

Fig. 5

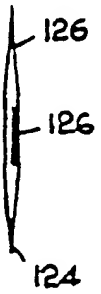

Fig. 7

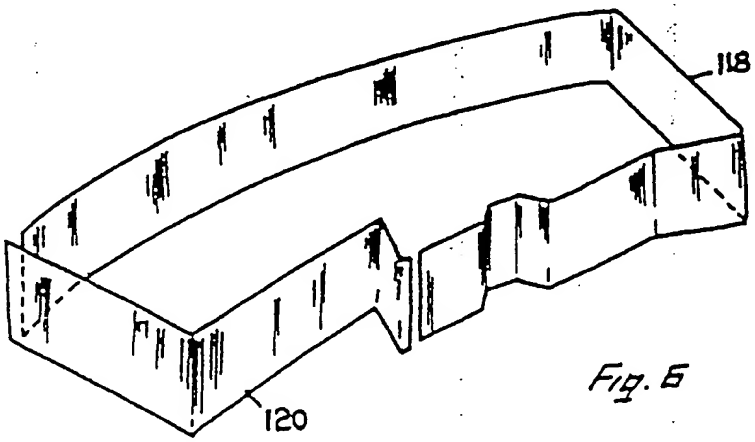

Fig. 6

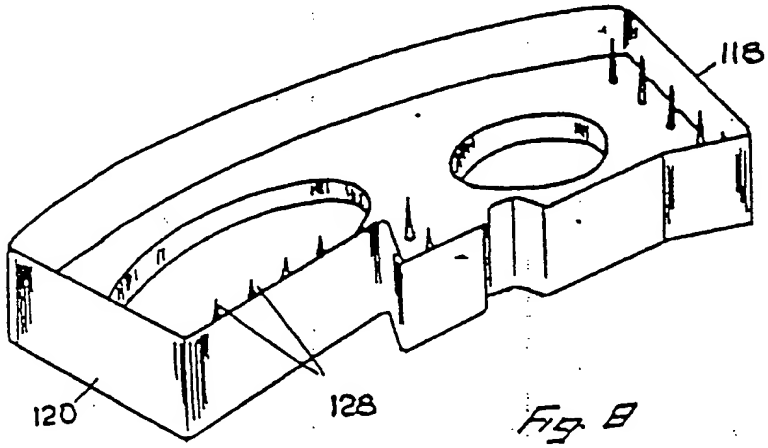

Fig. 8

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